

MOTORVAC® **Cool Smoke**

EVAP Leak Detection System

Part No. 500-0100



USER MANUAL



Canada & USA Patents: 6,907,771 2,438,448. International Patents Pending

CE **ISO 9001**
CERTIFIED

Introduction

Congratulations! You are in possession of the most useful, yet simple to operate Evaporative Emissions (EVAP) System diagnostic tester available today. This patented Cool Smoke technology creates diagnostic vapour without the need for high temperature glow plugs or resistance coils. When testing an EVAP system an inert gas such as nitrogen should be used to reduce the risk associated with introducing air into a gas tank.

The MotorVac Cool Smoke was specifically developed to OEM specifications for diagnosing vehicle EVAP system leaks. Additionally, the MotorVac Cool Smoke will also find intake manifold system leaks, exhaust system leaks and under-dash vacuum system leaks. It will also diagnose many other closed systems where you may suspect a leak, as well as pinpointing wind and water leaks entering the vehicle's passenger and trunk compartments. Its unique design allows the operator to confirm the integrity of the system being tested by utilizing a metered-air system. If the tool has confirmed a leak in the system being tested, the tool then introduces a special non-toxic diagnostic marked-vapor (smoke) into the system. To locate the source of the leak you simply look for the smoke exiting the leak or use the optional UV Phazer NEO™ light to view the UV deposit left behind, pinpointing the exact location of the leak. (PN: 413025)

Please study this User Guide to become thoroughly familiar with the Cool Smoke.
Thank you for choosing MotorVac.

Sincerely,

The MotorVac Team.



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Dual Mode Operation

The MotorVac Cool Smoke leak tester utilizes two separate modes for testing:

LEAK TEST MODE: Allows you to quickly determine if a leak exists without smoke.

SMOKE MODE: Quickly finds the leak utilizing both visual-vapour (smoke) and UV dye deposits.

The Cool Smoke fluid is a unique solution that allows for highly visible vapour (smoke) to carry UV dye to leak points. The UV dye will be deposited at small leak locations where the smoke is forced out a leak. Your MotorVac Cool Smoke automatically sets the critical pressure that must be maintained during EVAP testing. You don't need to set flow rates and you don't need to be concerned with ambient temperatures or barometric pressures. The MotorVac Cool Smoke is refillable by the end-user when the smoke-producing solution is depleted. The smoke it produces, as well as the UV dye, is non-toxic and noncorrosive. The MotorVac Cool Smoke needs no assembly; it is self-calibrating and requires no maintenance.

Technical Specifications

Height	12.25 in (31 cm)	Current Usage	0.75 A
Width	13.75 in (35 cm)	Inlet pressure required	80-150 psi (5.5-10.3 bar)
Depth	11 in (28 cm)	Output pressure	13 in H2O (0.03 bar)
Weight	15 lbs (6.8 kg)	Output volume	0.14 SCFM (3.9 L/min)
Ship Weight	18.5 lbs (8.4 kg)	Smoke outlet line	10 ft (3 m)
Power Supply	12 VDC	Power Cord	10 ft (3 m)

Getting to Know the Cool Smoke



Component description:

1. **SMOKE SOLUTION DIPSTICK:** Measure fluid level with dipstick fully installed. Keep fluid level in hatched area on the dipstick. The unit is filled through the dipstick tube.
CAUTION: DO NOT OVERFILL THE UNIT.
2. **SMOKE BUTTON:** Press to activate smoke creating mode, press again to cancel smoke creating mode. Note: The unit will automatically stop creating smoke after 5 minutes.
3. **SMOKE LED:** Turns on when the unit is in smoke creating mode.
4. **LEAK LED:** Turns on when unit is in leak testing mode.
5. **LEAK TEST BUTTON:** Press to activate leak mode. Press again to cancel leak mode.
6. **COMPOUND PRESSURE/VACUUM GAUGE:** Can be used to verify leaks by pressure or vacuum decay in the system. To find the size of the leak the flow meter must be used.
7. **FLOW METER:** When the unit is in leak detection mode the level that the ball settles to indicates the size of the leak in the system. If the ball is at the bottom of the gauge there is no leak.
8. **COMPRESSED GAS INLET:** Connect appropriate male quick coupler to supply the Cool Smoke with compressed inert gas if testing an EVAP system or compressed air for general smoke purposes.
9. **SMOKE HOSE:** Used to connect the Cool Smoke to the system being tested in either smoke or leak mode.
10. **POWER CABLES:** Connect to 12-volt DC power.
11. **WIRE AND HOSE STRAP:** Use this to safely store both the power cables and smoke hose when the unit is not in use.

To prevent personal injury and / or damage to vehicle or equipment:

- Many automotive manufacturers require the use of nitrogen to be used while testing the EVAP system. This is because a high heat source or spark could ignite fuel vapours mixed with air. The Cool Smoke does not use potentially hazardous high temperature glow plugs or resistance coils to create smoke. However nitrogen should be used to reduce the ignition risk if other potential ignition sources are nearby. The Cool Smoke can perform it's functions using clean and dry conventional shop air.
- Use this equipment in the manner specified by the manufacturer.
- Understand operating procedures / Follow all safety precautions.
- Correctly connect power supply to battery and chassis ground. Top-off smoke-producing solution throughout the year.
- Use only Cool Smoke Smoke Solution No. 400-1054. Altering the solution, hoses, cables or any other replacement parts will void the warranty; may cause tester malfunction; may cause damage to the vehicle, to property or may cause personal injury.
- To view the dye deposit, use the optional UV Phazer NEO™ light. (PN: 413025)
- Wear yellow glasses that are provided with the UV light to view dye.
- Do not use with running vehicle engine.
- Do not perform test near source of spark or ignition.
- Never leave the tester's hoses or power cables connected to the vehicle for extended periods of time if tests aren't being performed.
- The 12V DC battery source you use to power the tester must be in good condition and fully charged.
- Wear eye protection that meets OSHA standards.
- Tester input pressure must be 80-150 psi (5.5-10.3 bar)

Store and operate the tester in upright position.

TIPS:

- Whenever possible allow the system to vent as far away from where the smoke is being introduced. This will purge the air and fill the system with smoke. Once the system is filled with smoke close the vent and allow the system to be pressurized.
- When testing an engine's intake or exhaust system for leaks, it is recommended that the engine be cold. Small leaks may be sealed due to thermal expansion.



The Cool Smoke comes supplied with a 200ml (6.8 oz.) bottle of Cool Smoke FLUID. (PN: 400-1054)

1. The unit needs to be filled with fluid before being used for the first time.
2. Remove the dipstick.
3. Install the bottle fill nozzle and pour fluid into the machine through the dipstick tube.
4. Connect appropriate air/gas fitting on the bulkhead at the back of the unit.

Your Cool Smoke is now ready for its first use!

Included Accessories



060-0005 – SERVICE PORT ADAPTER (standard size) connects to factory service port on most OBD-II vehicles.



060-0008 – SCHRADER REMOVAL / INSTALLATION TOOL fits both sizes of Schrader valves in vehicles with factory OBD-II service port fittings.



200-8687 – EXHAUST CONES: Used to either introduce smoke into the exhaust system; into any system that fits the cone's tapered size; is used as an exhaust plug when testing a dual exhaust system; or exhaust plug when testing the intake vacuum system.



200-3110 – CAP PLUG KIT: Used to seal the intake ducting of the engine being tested. They may be used to seal either the inside diameter of an opening, or flip them over and seal the opening at the outside diameter.



060-0007 – SMOKE DIFFUSER: Allows the operator to lay down a thick path of smoke along doors, sunroof, windshield and window seams so any air disturbance, caused by exiting internal cabin pressure, may be observed.



400-1054 – COOL SMOKE FLUID: Every new unit arrives with a 200ml (6.8 oz.) bottle full charge of fluid. We recommend replacing the tester's solution once a year in order to keep the solution's fluorescence fresh.



413016 – 50 WATT LAMP: This powerful white light makes it easy to find smoke (16 ft./4.88 m power cable w/ battery clips)

Optional Accessories



413025 – UV PHAZER NEO: High output UV LED fluoresces dyes brighter for faster diagnosis and repair. Compact and cordless, the NEO uses a rechargeable Lithium Ion battery.

EVAP System Overview

The vehicle's Fuel Vapor Recovery System is the most neglected part of the vehicle's emission system, according to the Environmental Protection Agency (EPA).

The vehicle's EVAP system is used to collect fuel vapors from the fuel tank. These vapors are stored in a canister filled with activated charcoal. The EVAP system allows the fuel vapors to be drawn from the canister and combust during certain operating conditions. This process is called canister purging since the fuel vapors are purged from the canister. OBD-II requires Powertrain Control Module (PCM) monitoring for proper operation of the EVAP system and for possible leaks to the atmosphere. A faulty EVAP system will allow hydrocarbons (HC) to escape into the atmosphere.

Factory emission tests have determined that an EVAP system with a leak as small as .020 can yield an average of 1.35 grams of HC per vehicle driven mile. This is over 30-times the current allowable exhaust emissions standard.

In addition to causing HC emissions, failure of this system wastes fuel and many times creates customer complaints of "gasoline odours". With the introduction of On Board Diagnostics (OBD), the vehicle is capable of determining that its evaporative system has a leak. Unfortunately it can not tell you the location of the leak. Prior to the technology in the MotorVac Cool Smoke, determining where a leak in the EVAP system was had been a difficult and time-consuming challenge.

EVAP Test Procedure

CAUTION – Many automakers require the use of a non-combustible gas such as nitrogen to be used while testing an EVAP system. This is because a heat source or spark could ignite fuel vapours when mixed with air. The MotorVac Cool Smoke does not introduce a dangerous heat source. However, other sources of spark or heat could be present in the surrounding area. The Cool Smoke can perform its functions using conventional shop air.

Test Setup:

1. ALL tests with the MotorVac Cool Smoke are performed with the engine off.
2. For OBD-II EVAP systems when the vehicle's engine is turned off the vent valve is normally open. Use a scan tool to close the EVAP System in order to perform any leak tests.
3. Connect the Motorvac Cool Smoke's red (+) battery clip to vehicle's positive battery terminal; connect the black (-) battery clip to a solid ground point as far from the battery as possible.
4. Connect shop air to the MotorVac Cool Smoke's inlet located at the back of the machine. Be sure supply pressure to the machine is between 80-150 psi (5.5-10.3 bar).
5. Verify the vehicle's fuel level is below the base of the fuel tank neck.
6. Locate the EVAP service port indicated by its green cap. Remove the schrader valve from the EVAP service port using the removal tool (060-0008) Note: The Schrader valve is a left hand thread, turn clockwise to remove.
7. Connect the service port adapter (060-0005) to the EVAP service port. Connect the Cool Smoke smoke hose to the service port adapter.

STEP 1

Leak Verification

TIP:

A common reason for EVAP codes is a faulty or improperly installed fuel cap. To rule out this possibility do not disturb the gas cap before performing a leak verification test. If the vehicle fails the leak size test ensure that the fuel cap is properly installed and redo the test. If you disturb the fuel cap before doing this test and the system does not show a leak you will not be able to determine if there is an intermittent leak or if the fuel cap was the problem.

1. Press the LEAK TEST button.
2. Observe the flow gauge. When the ball stops settling, the location indicates the leak size in the system.
Note: This may take a few minutes depending on the size of the system.

TIP:

The flow rate while making smoke is greater. To pressurize the system faster press smoke and allow it to fill the system until you hear the solenoid cycling. Then press LEAK to perform the leak test.

STEP 2

Finding the leak

TIP:

It is best to perform all testing in calm air, so that the smoke exiting the leak will not be blown away impairing your view of the leak.

1. Ensure all steps outlined in test setup were followed. For best performance fully unwind the outlet hose.
2. Remove the fuel cap. This allows the air out and the unit to fully fill the system with smoke.
3. Press the SMOKE button to begin creating smoke. The tester has a built in 5 minute timer and will stop making smoke when the timer expires. To stop making smoke earlier press the SMOKE button.
4. After a solid stream of smoke is observed exiting the fuel fill neck, reinstall the fuel cap. The solenoid will cycle the system on and off as it comes up to pressure.

TIP:

For intermittent leaks watch the ball in the flow meter while doing a wiggle test on EVAP system components (hoses, connections etc.) If the ball goes up only when you wiggle a component this indicates an intermittent leak.

5. Using the supplied halogen light search the EVAP system for smoke exiting a leak.
6. UV light can be used to pinpoint leak locations. This is useful for hard to see locations such as the top of the fuel tank or behind panels.

TIP:

The longer smoke is allowed to exit a leak more UV dye is deposited at the leak location.

7. Repair the leaks and perform the leak test again to verify repair and that there are not more leaks present in the system.

Other Leak Detection Applications

- Vacuum and induction leaks
- Exhaust leaks
- EGR valve leaks
- Oil seals and gasket leaks
- Idle motors and solenoid leaks
- Brake booster leaks
- Component testing (radiators, water pumps and valves)
- Under dash leaks
- Intercooler and turbo charger leaks
- Wind and water leaks (windows & sunroofs)

Vacuum and Induction Leaks

1. Select the correct size cap plug (supplied) to seal the system, but do not seal the system yet. (You should first fill the system with smoke before you seal the system with the cap plug).
2. It is best to seal the engine's intake as close to the air inlet as possible to inspect the entire system. This is especially important on engines equipped with mass airflow sensors and related ducting connecting it to the intake system. If the system you are testing cannot be sealed with the kit we have provided, it will become necessary to seal the intake by other means. For example; wrap the vehicle's air filter with plastic wrap and reinstall into the air filter housing and secure. The plastic wrap will prevent most of the smoke from exiting the intake system, allowing you to create a satisfactory seal in the system you are testing for leaks. Or you may choose to use a latex rubber glove and a strong rubber band to accomplish this task. Simply stretch the wrist of the glove around the air passage and secure with the rubber band. You may choose to plug the tail pipe of the vehicle with the exhaust cone that is provided. Ensure that the exhaust cone's hose is also plugged. (It is possible that smoke pressure can be lost out the exhaust if both an intake and exhaust valves are open in the same cylinder at the same time).
3. Select a vacuum line on the engine that is easily accessible and insert the tapered brass nozzle into this line.
4. The supply line to the brake booster is a good choice when introducing smoke into the intake manifold. It is important to make sure that you enter this line at a point where the check valve will not interfere with the smoke flow.
5. Press the SMOKE button on the unit. Allow the system to fully fill with smoke. (30 seconds to 1 minute is usually sufficient time to fill the induction system).
6. Seal the system with the cap plug once smoke is observed exiting a leak.
7. Use the halogen light supplied to identify the origin of the smoke or use the optional UV Phazer NEO™ light to look for residual traces of the fluorescent dye that was left behind by the smoke. (PN: 413025)

Other Leak Detection Applications (Cont.)

Exhaust Leaks

Escaping exhaust gases can be very dangerous to the occupants of a vehicle yet these repairs are neglected — but so easy to find with the MotorVac Cool Smoke.

1. Put the vehicle on a lift to expose the underside. With the engine turned off, simply insert the exhaust adapter cone into the tail pipe of the vehicle being tested. Insert the smoke supply line nozzle into the exhaust cone's hose opening. On dual exhaust systems ensure that each tail pipe is plugged.
2. Look for the smoke exiting wherever there is a leak.
3. Even though exhaust leaks are very easy to find with MotorVac Cool Smoke, here are three helpful tips to make finding exhaust leaks even easier:
 - It is best to test a cold exhaust system rather than a hot one.
 - The catalytic converter may consume some of the smoke. But most importantly, many small exhaust leaks are only visible on a cold exhaust system due to 'thermal expansion'.
 - Seal off the vehicle's intake system in order to achieve proper system pressure in the event both an intake and exhaust valve are open in the same cylinder at the same time.

EGR Valve Leaks

The exhaust gas re-circulating (EGR) valve is at the heart of the emission control system. Since the EGR valve operates in such a hostile environment it is susceptible to leakage. During a normal test for vacuum leaks, the EGR valve will be exposed to smoke and may show leaks at the seat, diaphragm, or even the base gasket. If smoke is seen exiting the EGR valve, disconnect the vacuum supply line and introduce smoke directly into the valve. This will verify if the diaphragm is leaking, or if the valve is leaking at the seat. Smoke may also be used to check the EGR ports for restriction. Open or remove the valve and introduce smoke through the tail pipe to verify that these ports are open.

TIP -

Testing the EGR Pintle Shaft: This will help you diagnose a good or bad EGR valve and other "metered" leaks.

1. Do not cap off any part of the engine – leave it in normal operating state (but NOT running). Insert the MotorVac Cool Smoke supply hose into a direct vacuum manifold source, such as a brake booster hose or PCV. Turn the tester ON. Watch for smoke to escape from the EGR valve. If you see a lot of smoke, move on to the next step.
2. Cap off the intake using one of the cap plugs supplied with the MotorVac Cool Smoke. Insert the exhaust cone into the tailpipe. (The hose on the exhaust cone should be plugged with the cap plug provided.) Now that the system is sealed, press the smoke button and watch for smoke. A small amount of smoke indicates an acceptable EGR valve.

Other Leak Detection Applications (Cont.)

Oil Seals and Gasket Leaks

Many oil leaks can be located with the MotorVac Cool Smoke. It is important to understand that the MotorVac Cool Smoke will only find leaks that will allow air to flow through them. Example: A cam seal may allow air to pass through whereas a drain plug or pressure sensor will not. To locate oil leaks it is necessary to pressurize the crankcase with smoke.

1. Remove the dipstick and slip a hose over the dipstick tube, and insert the smoke supply nozzle into the hose.
2. Plug the PCV, air breather, and intake. Remove the oil filler cap.
3. Introduce smoke into the crankcase until smoke is seen exiting the oil filler port.
4. Install the oil filler cap and continue filling the system.
5. Use the spotlight to check for leaks, which could appear as seeping smoke, bubbling oil with little or no smoke, or dripping oil with no smoke at all.

Brake Booster Leaks

A leaking vacuum brake booster not only effects engine performance like other types of vacuum leaks, but more importantly, it can seriously affect the stopping power of the vehicle. The brake booster is a simple component to check for leaks.

1. Disconnect the vacuum supply line and the check valve from the brake booster.
2. Insert the smoke supply nozzle into the brake booster and begin introducing smoke.
3. Under the hood, look for smoke exiting around the crimped area of the booster canister. Also look inside the vehicle under the dash. NOTE: Do not depress the brake pedal while performing this test.

Component Leak Testing (radiators, water pumps, valves, etc.)

When installing new or rebuilt parts nothing is more frustrating than to discover on completion of the job that the component is faulty, or has a leak. It is far easier to inspect a radiator or water pump before it is installed than to find out after the job is completed and the antifreeze is installed, that there is a leak. Component leak testing has endless possibilities; anything from hoses to diaphragms can be tested. Supplied with every MotorVac Cool Smoke is an exhaust cone adapter that can be used to access any opening from 1" to 3 ½". Simply introduce smoke into the system being tested, seal any inter-connecting ports or passages and look for the smoke or dye to exit a leak.

Other Leak Detection Applications (Cont.)

Under Dash Leaks

Under dashboard leaks can be very difficult to locate. The MotorVac Cool Smoke can confirm or eliminate the possibility of an under dash leak in minutes. Most vehicles have a common vacuum supply line that originates at the engine intake. This vacuum source comes through the firewall to supply the climate control functions as well as other systems in the vehicle. Vacuum systems under the dashboard are intended to be closed systems; any flow through these systems would indicate that there is a leak present.

1. Connect the supply nozzle to the main vacuum line (beyond the check valve) leading to the dashboard.
2. Press LEAK TEST button to introduce air into the system and watch the flow meter's indicator ball. If the ball drops to zero the system is leak-free.
3. Continue to introduce air into the system while testing each setting on the climate control. Watch the flow meter for any indication of flow, confirming a leak.
4. Set the selector switch on the tester to SMOKE and introduce smoke into the position determined to have a leak. Use the spotlight to look for the smoke exiting the leak, or use a UV lamp to look for the dye deposited.

Intercooler and Turbo Charger Leaks

Engine compartments with turbochargers tend to run hotter than normally aspirated engines causing hoses and seals to dry out and leak. For turbocharged systems to operate efficiently there can be no leaks in the intercooler, ducting, exhaust or the turbo itself. Intercoolers and turbochargers are tested with the engine off, as with all tests performed with the MotorVac Cool Smoke.

1. Connect the smoke supply line to the intake system.
2. Introduce smoke into the "cold" side of the turbocharger.
3. While the intake is under smoke pressure, inspect the intercooler, the ducting, the waste gate, and the cold side of the turbo for leaks.
4. To inspect the "hot" side or exhaust side of the turbo for leaks, install the exhaust cone into the exhaust pipe. Introduce smoke and inspect the exhaust, the exhaust manifold, and the hot side of the turbocharger.

Other Leak Detection Applications (Cont.)

Wind and Water Leaks from sunroofs, windows and windshields

One of the toughest leaks to find on an automobile is wind / water leaks around the doors, windows, and sunroofs. It isn't safe or practical to search for these leaks while driving at highway speeds although that is when they are most noticeable. Old fashioned ways of locating where the wind and water is entering the vehicle may identify the leak, but this does not locate the origin of the leak, as you can with the MotorVac Cool Smoke.

1. Park the vehicle in an area that is shielded from the wind (preferably inside a closed facility).
2. Turn the vehicle's ignition to the ACCESSORIES position.
3. Turn the heater/AC blower to FRESH AIR and HIGH.
(Verify the blower is NOT set to the re-circulation mode.)
4. Close the vehicle's doors and windows. The cabin of the vehicle is now under a slight positive pressure.
5. Attach the included diffuser to the end of the tester's hose.
6. Press the SMOKE button.
7. From outside the vehicle, position the tip of the diffuser about 2 – 3 inches away from the vehicle, and follow a path along the areas you wish to test. The smoke will linger on the path you are following until a leak is present. The air exiting the vehicle will cause the smoke to be disrupted, identifying the source of the leak.

Trouble Shooting Chart

Symptom	Possible Cause	Solution
Gurgling sound while making smoke or fluctuation on the flow gauge while in leak detection mode.	<ol style="list-style-type: none">1. The tank may be overfilled.2. Fluid has condensed in the outlet hose.	Pull the outlet hose off the unit and make smoke again. If the gurgling sound is gone fluid has condensed in the outlet hose. Let the hose hang down vertically so any fluid drains out of the line.
The ball on the flow gauge hangs up or sticks	Dirt or moisture from contaminated supply air has entered the gauge.	Ensure that the shop air being used is properly filtered and dried. Allow clean air to run through the machine until the contamination has cleared.



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